Exhibit F: Conceptual Wildlife Mitigation Measures

CONCEPTUAL WILDLIFE MITIGATION MEASURES

Conceptual wildlife management measures for the 9 proposed mitigation sites are described in detail in the following text. Property location, acreage, habitat acreage objectives, and physical measures to implement the mitigation concepts are discussed in detail. The information provided was used to develop detailed cost estimates for implementation and operation and management of each site. Information on habitat acreage was also incorporated into the HEP analysis of mitigation sites to help determine the production of AAHU's on a site-specific basis.

Site-specific mitigation concepts were presented in written draft to the interagency HEP team members for review and comment. Additionally, interagency HEP team members were provided a site tour of the proposed mitigation sites where further comments on mitigation measures were requested.

JOSLIN PROPERTY MITIGATION SITE

The Joslin Property is located on the upstream end of Sauvie Island. Access to the site is from Oregon Highway 30 and by paved county road on Sauvie Island.

The mitigation concepts at Joslin Property are directed toward development of wetland and riparian habitats. The site is approximately 124 acres in extent. Riparian habitat management (41.4 acres) and development (28.7 acres) would encompass 70.1 acres. Approximately 50.5 acres of wetland habitat would be developed and enhanced through construction of a levee and associated water control structures.

Wetland habitat development would require the emplacement of a water control structure featuring a 24-inch diameter, 52 foot long, corrugated steel pipe (CSP) to include a 4' (height), .064 wall thickness, 30" diameter CSP flashboard riser, with a welded bottom plate and 2' stub of 24" CSP (0.064). Pipe and riser would be asphalt dipped. The structure would be placed in the constructed levee at the location of the current drainage culvert under the county road and would require minor excavation and backfill.

An electrical, volume pump to maintain drainage from adjacent lands and to provide water supply to the wetland would be required. Installment of overhead electrical service would be required including drop to existing pole and electrical panel. The pump station would be mounted on a 10' x 10' platform atop 4-20' pilings sunk 10' each.

Another habitat feature of the wetland habitat development effort would be the construction of 5,750 feet of levees. Levee crest is 4 feet above ground surface, crest width is 4', and both sideslopes are 1V:6H. Borrow material for the levee would be native materials acquired on the immediate site; primarily from sloping from the road borrow ditches to the crest of the levee. Additional borrow material could be obtained as needed by construction of shallow impoundments on lands immediately adjacent to the levee to be constructed. Repeated passes of the caterpillar would accomplish compaction and leveling of the levee. An estimated 24,150 embankment cubic yards (4.2 cy/lf)

would be required for this feature. A maximum of 2,000 cy of material is estimated to be available from sloping of roadside ditches. Scrapers could be used for borrow material not obtained from sloping of road borrow ditches. Scraper borrow sites would be shallow, e.g., no greater than 3 feet in depth with slopes of approximately 1V:12H to ground surface elevation. These shallow scrapes are intended to serve as wetland ponds post-construction. Levee construction would be in late summer or early fall when site is dry and equipment can be operated.

Removal of an estimated 8,500 feet of fence; estimate 4-strand barbwire with 515 posts to be removed of which 412 are 6.5' steel posts and 103 are wooden posts.

Riparian habitat would be planted on 6.6 acres of levee. Riparian plantings would occur on an additional 22.1 acres for a total riparian planting of 28.7 acres. Planting density would be 400 cuttings/seedlings per acre. Species composition per acre would be 250 black cottonwoods, 100 willows, and 50 Oregon ash. Total material requirements are 7,175 black cottonwood and 2,870 willow cuttings, and 1,435 Oregon ash seedlings; total cuttings equal 10,045. Establishment of riparian trees would be accomplished via sticking of 18" cuttings of willow and black cottonwood, and planting of Oregon ash seedlings in the late February-early March timeframe. Cuttings would be obtained from onsite or adjacent lands on Sauvie Island. Oregon ash seedlings would be started in containers from seeds collected locally. Approximately 18 acres designated for riparian plantings would require scarification by a dozer. Tillage and scarification operations would be conducted in the fall of the year.

Changes in management actions for existing riparian habitat are expected to generate benefits for wildlife resources. These include removal of cattle from the land and eradication of blackberry thickets currently present on the site.

Post-implementation, operations and maintenance would focus on the water control structures, levee, and blackberry control/eradication.

VANCOUVER LOWLANDS MITIGATION IMPLEMENTATION

The Vancouver Lowlands property is located adjacent to Vancouver Lake near Vancouver, Washington. The Port of Vancouver owns the property. The lands targeted for mitigation actions are presently used for agricultural crop production. Access to the mitigation location is via Lower River Road.

The mitigation concepts at Vancouver Lowlands are directed toward development of forage for Canada geese. Permanent grassland, principally for waterfowl (Canada goose) forage would be developed on 273 acres. Post-migration of geese in mid-April, the grassland would be allowed to grow and seed out in order to benefit grassland bird species, raptors, reptiles, amphibians and small rodents. In September each year just prior to the arrival of migrant Canada geese, the grassland would be swathed, chopped through a silage chopper with the residue blown back onto the field as mulch, and fertilized. A spring application of fertilizer would occur in late March or April each year.

Initial tillage and seeding would occur in late April-May after the northward migration of geese has begun and site conditions allow for tillage. The site would be disked and harrowed (1 pass; equipment in combination; light drag harrow), plowed (1 pass), smoothed with a heavy drag harrow (2 passes), compacted with a cultipacker, light drag harrow and roller in combination (1 pass), drilled (1 pass) and cultipacked, harrowed and rolled (1 pass).

Equipment requirements--all equipment must be field ready at rental; prefer new equipment over used equipment for rental purposes:

2 - 150hp tractors; both equipped with duals; 2wd or 4wd; two hydraulic remotes each.
1 - 15 foot cover crop disk, wheeled, with hydraulic cylinders, hoses and attachments
1 - 4 bottom switchplow with hydraulic cylinders, hoses and attachments
1 - 16 foot heavy drag harrow, wheeled with hydraulic cylinders, hoses and attachments
1 - 16 foot cultipacker with hydraulic cylinders, hoses and attachments
1 - 16 foot sprocket roller with hydraulic cylinders, hoses and attachments
1 - 12 foot drill set up for grass seed with hydraulic cylinders, hoses and attachments
1 - 16 foot light drag harrow, sectional, with all attachments

Use equipment rental for tractors and field implements. Equipment rentals are for a minimum one month term. Work to be accomplished can be completed in one month.

Requires 2 operators; assume 12 hour days/operator during field season
Requires 1-ton service/maintenance vehicle
Fuel service for tractors; includes bulk tank on site.

Field time for tractors:

Cover crop disk in combination with harrow - 6 acres/hr; 46 hrs for 273 ac - say 60 hrs.
Plowing - 3 ac/hr; 91 hrs for 273 ac - say 108 hrs
Heavy drag harrow - 6 ac/hr; 46 hrs x 2 passes = 92 hrs; say 108 hrs. for 273 ac
Cultipacker compaction - 8 ac/hr; 35 hrs x 3 passes = 105 hrs; say 120 hrs. for 273 ac
Drilling - 6 ac/hr - 46 hrs for 273 ac - say 60 hrs.

Mob/Demob to Vancouver Lowlands (use Woodburn, Oregon as base for mileage)

Assume 50% downtime due to weather conditions.
Base fuel and miscellaneous service costs on total tractor hours; say $5,000.

Seed - Commercial pasture mix at rate of 20 lbs/acre; estimate $2.00/lb; 20x273x$2.00 = $10,920.

Fertilizer:
Spring Application - Apply 300 lbs/ac with objective of 100 lbs/ac actual Nitrogen = 81,900 lbs; say 82,000 lbs. Or 41 tons at $300/ton = $12,300.
Application by commercial applicator - $10/acre; say $2,730

Fall Application Apply 200 lbs/ac with objective of 67 lbs/ac actual Nitrogen = 54,600 lbs; say 56,000 lbs. Or 28 tons at $300/ton = $8,400
Application by commercial applicator - $10/acre; say $2,730

Operation and maintenance actions consist primarily of spring and fall fertilizer applications and fall removal of dense grass growth in order to allow for development of new grass and clover growth nutritious and palatable for geese.

SAUVIE 94 MITIGATION IMPLEMENTATION

Sauvie 94 is an enclave of private lands bounded by ODFW's Sauvie Island Wildlife Management Area and the Columbia River. The site is at approximately CRM 94 and lies immediately off Reeder Road.

The mitigation concepts at Sauvie 94 are directed toward development of wetland, riparian and Canada goose forage habitats. The site is approximately 204 acres in extent. Permanent Canada goose forage habitat would be developed on approximately 116 acres at this location. Riparian habitat development (7.5 acres) and development (12.6 acres) would encompass approximately 20 acres. Approximately 68 acres of wetland habitat would be developed.

Wetland habitat development would require the emplacement of two water control structures; each structure features a 24-inch diameter, 52 foot long, corrugated steel pipe (CSP) to include a 4' (height), .064 wall thickness, 30" diameter CSP flashboard riser, with a welded bottom plate and 2' stub of 24" CSP (0.064). Pipe and riser would be asphalt dipped. Both structures would be placed in an existing ditch and would require minor excavation and backfill. Additionally, both structures would have rock dikes constructed to preclude carp entry into the wetland. Both rock dikes would be constructed of 3" minus, clean gravel and would be exterior to the main levees. An electrical pumping station would be constructed at the southern levee for auxiliary water supply and/or to drain the wetland if necessary.

Materials requirements for the water control structures are:

280 cys of clean (no fines) 3" minus rock
400 cys - excavation
40 cys - pipe bedding
1 - 24" dia., 56 foot long and 1 - 24" dia., 60 foot long , corrugated steel pipe (CSP), each to include a 8' (height), .064 wall thickness, 30" diameter CSP flashboard riser, with a welded bottom plate and 2' stub of 24" CSP (0.064). Pipe and riser would be asphalt dipped.
100 cys Class II riprap
50 sq. ft. of trash rack

An electrical, volume pump to maintain drainage and provide water supply to the wetland would be required. Pump specifications are comparable to that designed for Joslin Property. Installment of overhead electrical service would be required including drop to existing pole and electrical panel. The pump station would be mounted on a 10' x 10' concrete platform atop the southern levee at the existing drainage ditch/road culvert location.

Another habitat feature of the wetland habitat development effort would be the construction of two levees; 1,470 and 1,500 lineal feet in length. Levee crest is 4 feet above ground surface, crest width is 4', and both sideslopes are 1V:6H. Borrow material for the levee would be native materials acquired on the immediate site. Borrow material

would be obtained by construction of shallow impoundments on lands immediately adjacent to the levee to be constructed. Repeated passes of the caterpillar would accomplish compaction and leveling. An estimated 12,500 embankment cubic yards (4.2 cy/lf) would be required for this feature. Scraper borrow sites would be shallow, e.g., no greater than 3 feet in depth with slopes of approximately 1V:12H to ground surface elevation. These shallow scrapes are intended to serve as wetland ponds post-construction. Levee construction would be in late summer or early fall when site is dry and equipment can operate.

Removal of an estimated 4,000 feet of fence; estimate 4-strand barbwire with 242 posts to be removed of which 194 are 6.5' steel posts and 48 are wooden posts.

Riparian habitat would be planted on 7.5 acres of land, to include levees that would be constructed. Planting density would be 400 cuttings/seedlings per acre. Species composition per acre would be 250 black cottonwoods, 100 willows, and 50 Oregon ash. Total material requirements are 1,875 black cottonwood and 750 willow cuttings, plus 375 Oregon ash seedlings; total cuttings equal 2,625. Establishment of riparian trees would be accomplished via sticking of 18" cuttings of willow and black cottonwood, and planting of Oregon ash seedlings in the late February-early March timeframe. Cuttings would be obtained from onsite, Martin and Burke Islands and/or riparian stands on the adjacent Wildlife Management Area. Seeds of Oregon ash would be collected from local stands and propagated in a nursery for seedling outplants.

Permanent grassland, principally for waterfowl (Canada goose) forage would be developed on 116 acres. Post-migration of geese in mid-April, the grassland would be allowed to grow and seed out in order to benefit grassland bird species, raptors, reptiles, amphibians and small rodents. In September each year just prior to the arrival of migrant Canada geese, the grassland would be swathed, chopped through a silage chopper with the residue blown back onto the field as mulch, and fertilized. A spring application of fertilizer would occur in late March or April each year.

Initial tillage and seeding would occur in late April-May after the northward migration of geese has begun and site conditions allow for tillage. . The site would be disked and harrowed (1 pass; equipment in combination; light drag harrow), plowed (1 pass), smoothed with a heavy drag harrow (2 passes), compacted with a cultipacker, light drag harrow and roller in combination (1 pass), drilled (1 pass) and cultipacked, harrowed and rolled (1 pass).

Equipment requirements, all equipment must be field ready at rental; prefer new equipment over used equipment for rental purposes:

2 - 150hp tractors; both equipped with duals; 2wd or 4wd; two hydraulic remotes each.

1 - 15 foot cover crop disk, wheeled, with hydraulic cylinders, hoses and attachments

1 - 4 bottom switchplow with hydraulic cylinders, hoses and attachments

1 - 16 foot heavy drag harrow, wheeled with hydraulic cylinders, hoses and attachments
1 - 16 foot cultipacker with hydraulic cylinders, hoses and attachments
1 - 16 foot sprocket roller with hydraulic cylinders, hoses and attachments
1 - 12 foot drill set up for grass seed with hydraulic cylinders, hoses and attachments
1 - 16 foot light drag harrow, sectional, with all attachments

Use equipment rental for tractors and field implements. Equipment rentals are for a minimum one month term. Work to be accomplished can be completed in one month.

Requires 2 operators; assume 12 hour days/operator during field season
Requires 1-ton service/maintenance vehicle
Fuel service for tractors; includes bulk tank on site.
Field time for tractors:

Cover crop disk in combination with harrow - 6 acres/hr; 19 hrs for 116 ac - say 24 hrs.
Ploughing - 3 ac/hr; 39 hrs for 116 ac - say 48 hrs
Heavy drag harrow - 6 ac/hr; 19 hrs x 2 passes = 38 hrs; say 48 hrs. for 116 ac.
Cultipacker compaction - 8 ac/hr; 14.5 hrs x 3 passes = 43.5 hrs; say 52 hrs. for 116 ac
Drilling - 6 ac/hr - 19 hrs; say 24 hrs for 116 ac

Mob/Demob to Woodland Bottoms (use Woodburn, Oregon as base for mileage)
Assume 50% downtime due to weather conditions.
Base fuel cost on total tractor hours; say $2,000.

Seed - Commercial pasture mix at rate of 20 lbs/acre; estimate $2.00/lb; 20x116x$2.00 = $4,640.

Fertilizer:
Spring Application - Apply 300 lbs/ac with objective of 100 lbs/ac actual Nitrogen = 34,800 lbs; say 36,000 lbs. Or 18 tons at $300/ton = $5,400
Application by commercial applicator - $10/acre; say $1,160

Fall Application Apply 200 lbs/ac with objective of 67 lbs/ac actual Nitrogen = 23,200 lbs; say 24,000 lbs. Or 12 tons at $300/ton = $3,600
Application by commercial applicator - $10/acre; say $1,160

Operation and maintenance actions consist primarily of spring and fall fertilizer applications and fall removal of dense grass growth in order to allow for development of new grass and clover growth nutritious and palatable for geese. Post-implementation of wetland and riparian habitat development features, operations and maintenance would focus on the water control structures, levees, and blackberry control/eradication.

BURKE ISLAND MITIGATION IMPLEMENTATION

Burke Island is located in the Columbia River (CRM 91) adjacent to the Woodland Bottoms. Access to the mitigation location is via the Dike Road exit off I-5 near Woodland, Washington. Dike Road leads to a bridge crossing at the upstream end of Burke Island.

The mitigation concepts at Burke Island are directed toward development of wetland and riparian habitats. Construction actions for development of mitigation habitat will entail approximately 164 acres. Riparian habitat development would encompass approximately 122 acres. Approximately 31 acres of wetland habitat would be developed and better management practices implemented on an additional 11 acres of wetlands currently subject to grazing by livestock.

Wetland habitat development would require the emplacement of four water control structures in the existing levee on Burke Island. Two water control structures would consist of reversed tidegates. Reversal of the tidegates would allow for natural flooding of the site, yet would retain water behind the levees when river levels fall. Porous, rock dikes would be constructed on the riverward side of the water control structures to preclude invasion of wetlands by carp and entrainment of juvenile salmonids. The other two water control structures would be used to drain the wetland habitat, as necessary, to control noxious plants or carp populations that result from overland floods. A reversed tidegate and a drainpipe water control structure would be constructed in tandem at each of two sites. The first site for the reversed tidegate and water control structure would be at the current location of an existing tidegate. The second site would be nearer to the mainstem Columbia River.

Materials requirements for water control structures:

140 cys of clean (no fines) 3" minus rock
150 cys - excavation
20 cys - pipe bedding
2 - 35', 48" dia. CMP
2 tidegates mounted on the upstream side (reverse of normal location)
2 - 24" dia., 35 foot long, corrugated steel pipe (CSP) to include a 8' (height), .064 wall thickness, 30" diameter CSP flashboard riser, with a welded bottom plate and 2' stub of 24" CSP (0.064). Pipe and riser would be asphalt dipped.
50 cys Class II riprap
50 sq. ft. of trash rack

Removal of an estimated 3,750 feet of fence; estimate 4-strand barbwire with 227 posts to be removed of which 182 are 6.5' steel posts and 45 are wooden posts.

Riparian habitat development would be via natural seeding of the site. To facilitate seed germination, the riparian habitat development area would be tilled in late April to mid-May immediately prior to seed fall from willows and cottonwoods. The site would be disked (2 passes), harrowed with a heavy drag harrow and then compacted with a cultipacker, light drag harrow and roller in combination (1 pass).

Equipment requirements--All equipment must be field ready at rental; prefer new equipment over used equipment for rental purposes.

2 - 150hp tractors; both equipped with duals; 2wd or 4wd; two hydraulic remotes each.

1 - 15 foot cover crop disk, wheeled, with hydraulic cylinders, hoses and attachments

1 - 16 foot heavy drag harrow, wheeled with hydraulic cylinders, hoses and attachments

1 - 16 foot cultipacker with hydraulic cylinders, hoses and attachments

1 - 16 foot sprocket roller with hydraulic cylinders, hoses and attachments

1 - 16 foot light drag harrow, sectional, with all attachments

Use equipment rental for tractors and field implements. Equipment rentals are for a minimum one month term. Work to be accomplished can be completed in one month.

Requires 2 operators; assume 12 hour days/operator during field season

Requires 1-ton service/maintenance vehicle

Fuel service for tractors; includes bulk tank on site.

Field time for tractors:

Cover crop disk-6 acres/hr; 20 hrs x 2 passes = 40 hrs; say 48 hrs. for 122 ac

Heavy drag harrow - 6 ac/hr; 20 hrs for 122 ac - say 24 hrs.

Cultipacker compaction - 8 ac/hr; 15 hrs x 1 pass = 15 hrs; say 18 hrs. for 122 ac

Mob/Demob to Woodland Bottoms (use Woodburn, Oregon as base for mileage)

Assume 50% downtime due to weather conditions.

Base fuel cost on total tractor hours.

Post-implementation, operations and maintenance would focus on the water control structures, levee, and blackberry control/eradication.

WOODLAND BOTTOMS MITIGATION IMPLEMENTATION

Access to the mitigation location is via the Dike Road exit off I-5 near Woodland, Washington. The land targeted for mitigation measures is currently in agricultural production, principally row crops, hybrid poplars and pasturelands.

The mitigation concepts at Woodland Bottoms are directed toward development of wetland, riparian and Canada goose forage habitats. The site is approximately 284 acres in extent. Permanent Canada goose forage habitat would be developed on approximately 132 acres at this location. Riparian habitat development and management would encompass approximately 44 acres. Approximately 97 acres of wetland habitat would be developed.

Wetland habitat development would require the emplacement of two water control structures; each structure features a 24-inch diameter, 52 foot long, corrugated steel pipe (CSP) to include a 4' (height), .064 wall thickness, 30" diameter CSP flashboard riser, with a welded bottom plate and 2' stub of 24" CSP (0.064). Pipe and riser would be asphalt dipped. One structure would be placed in an existing ditch and would require minor excavation and backfill. The other structure would also be placed in an existing drainage ditch but would be incorporated into the constructed levee feature.

Materials requirements for water control structures and the breach of one levee are:

140 cys of clean (no fines) 3" minus rock
200 cys - excavation
20 cys - pipe bedding
1 - 24" dia., 56 foot long and 1 - 24" dia., 60 foot long , corrugated steel pipe (CSP), each to include a 8' (height), .064 wall thickness, 30" diameter CSP flashboard riser, with a welded bottom plate and 2' stub of 24" CSP (0.064). Pipe and riser would be asphalt dipped.
50 cys Class II riprap
50 sq. ft. of trash rack

Another habitat feature of the wetland habitat development effort would be the construction of 4,625 feet of levees. Levee crest is 4 feet above ground surface, crest width is 4', and both sideslopes are 1V:6H. Borrow material for the levee would be native materials acquired on the immediate site. An estimated 1,375' of existing ditch would be sloped to 1V:6H sideslopes and borrowed material incorporated into the adjacent levee section. The remaining material for the 1,375-foot section of levee and materials for the 3,250' levee section would be pushed up by caterpillar. Repeated passes of the caterpillar would accomplish compaction and leveling. An estimated 19,425 embankment cubic yards (4.2 cy/lf) would be required for this feature.

Removal of an estimated 16,500 feet of fence is required; estimate 4-strand barbwire with 1,000 posts to be removed of which 800 are 6.5' steel posts and 200 are wooden posts.

Riparian habitat would be planted on the 44 acres land and on levees that are either in place currently or that would be constructed. Planting density would be 400 cuttings/seedlings per acre. Species composition per acre would be 250 black cottonwoods, 100 willow and 50 Oregon ash. Material requirements are 11,000 black cottonwood and 4,400 willow cuttings, and 2,200 Oregon ash seedlings; total cuttings equal 15,400. Establishment of riparian trees would be accomplished via sticking of 18" cuttings of willow, Oregon ash and black cottonwood in the late February-early March timeframe. Cuttings and Oregon ash seeds would be obtained from onsite, Martin and Burke Islands or another local area.

Permanent grassland, principally for waterfowl (Canada goose) forage would be developed on 132 acres. Initial tillage and seeding would occur in late April-May. The site would be disked and harrowed (1 pass; equipment in combination; light drag harrow), plowed (1 pass), smoothed with a heavy drag harrow (2 passes), compacted with a cultipacker, light drag harrow and roller in combination (1 pass), drilled (1 pass) and cultipacked, harrowed and rolled (1 pass).

Equipment requirements--all equipment must be field ready at rental; prefer new equipment over used equipment for rental purposes:

2 - 150hp tractors; both equipped with duals; 2wd or 4wd; two hydraulic remotes each.
1 - 15 foot cover crop disk, wheeled, with hydraulic cylinders, hoses and attachments
1 - 4 bottom switchplow with hydraulic cylinders, hoses and attachments
1 - 16 foot heavy drag harrow, wheeled with hydraulic cylinders, hoses and attachments
1 - 16 foot cultipacker with hydraulic cylinders, hoses and attachments
1 - 16 foot sprocket roller with hydraulic cylinders, hoses and attachments
1 - 12 foot drill set up for grass seed with hydraulic cylinders, hoses and attachments
1 - 16 foot light drag harrow, sectional, with all attachments

Use equipment rental for tractors and field implements. Equipment rentals are for a minimum one month term. Work to be accomplished can be completed in one month.

Requires 2 operators; assume 12 hour days/operator during field season
Requires 1-ton service/maintenance vehicle
Fuel service for tractors; includes bulk tank on site.
Field time for tractors:

Cover crop disk in combination with harrow - 6 acres/hr; 22 hrs for 132 ac - say 30 hrs.
Plowing - 3 ac/hr; 44 hrs for 132 ac - say 52 hrs
Heavy drag harrow - 6 ac/hr; 22 hrs x 2 passes = 44 hrs; say 52 hrs. for 132 ac
Cultipacker compaction - 8 ac/hr; 16.5 hrs x 3 passes = 49.5 hrs; say 60 hrs. for 132 ac
Drilling - 6 ac/hr - 22 hrs; say 30 hrs for 132 ac

Mob/Demob to Woodland Bottoms (use Woodburn, Oregon as base for mileage)
Assume 50% downtime due to weather conditions.
Base fuel cost on total tractor hours.

Seed - Commercial pasture mix at rate of 20 lbs/acre; estimate $2.00/lb;
20x132x$2.00 = $5,280.

Fertilizer:
Spring Application - Apply 300 lbs/ac with objective of 100 lbs/ac actual Nitrogen = 39,600 lbs; say 40,000 lbs. Or 20 tons at $300/ton = $6,000
Application by commercial applicator - $10/acre; say $1,320

Fall Application - Apply 200 lbs/ac with objective of 67 lbs/ac actual Nitrogen = 26,400 lbs; say 27,000 lbs. Or 14 tons at $300/ton = $4,200
Application by commercial applicator - $10/acre; say $1,320

Operation and maintenance actions consist primarily of spring and fall fertilizer applications and fall removal of dense grass growth in order to allow for development of new grass and clover growth nutritious and palatable for geese. Post-implementation of wetland and riparian habitat development features, operations and maintenance would focus on the water control structures, levees, and blackberry control/eradication.

MARTIN ISLAND MITIGATION IMPLEMENTATION

Martin Island is a natural island in the Columbia River at CRM 80. The island is separated from the Washington mainland by a side channel which is abutted by Interstate 5. Martin Island is approximately halfway between Woodland and Kalama, Washington on Interstate 5. Current land use is for agricultural pastureland. Tracts of riparian forest are present at the location plus a 35-acre constructed embayment.

The mitigation concept at Martin Island is two-fold. Management emphasis will be directed toward riparian forest and emergent marsh habitat. Reestablishment of riparian forest habitat will encompass the majority of the acreage at this location. This will entail the development of riparian forest on the acreage currently devoted to cattle pasture. Improvement in habitat conditions for the existing block of riparian forest is also forecast with removal of cattle from the island but will not require physical measures on the landscape.

Emergent marsh habitat (34 acres) would be developed in the 35.3-acre, previously constructed embayment and entrance channel, at Martin Island. The entrance channel would not be altered or developed. Development of emergent marsh habitat at this location would initially entail disposal of dredged material in the embayment to bring the bottom elevation to near the point where emergent marsh vegetation would become established. Top-soil would be borrowed from the waste area on Martin Island that resulted from the embayment construction to provide two feet of soil atop the sand placed in the embayment. Site elevation would be designed to allow for emergent marsh habitat development under normal tidal conditions.

Emergent marsh habitat development would use 1,125,000 cubic yards of dredged material from construction and first year maintenance of the navigation channel. Dredged material would be obtained from CRM 79-84; material obtained from within those river miles would extend upstream only to that point where further pumping would require a booster pump. The cost to the mitigation component of the project from use of dredged material would only be the incremental cost above disposal costs at the identified site on Martin Island in the least cost plan. Disposal in the embayment would require an estimated 2,000 feet of additional pipeline, based upon the distance from the center of the identified upland disposal site to the center of the embayment. The entrance channel to the embayment would be used as a weir location for drainage of excess water. Weirs would be constructed at either end of the entrance channel by bulldozing soil from the adjacent uplands to form the plug into which the weirs would be incorporated. Weirs would be removed upon completion of the intertidal marsh habitat.

Two feet of topsoil, e.g. 110,000 cy, would be placed atop the 1,125,000 cy of dredged material at the end of the second dredging season. Topsoil would be obtained by borrowing material from adjacent lands where a portion of the overburden from the embayment construction was initially placed. Topsoil placed in the embayment will occur in the dry to obtain a uniform coverage. To obtain dry conditions, the innermost weir will be plugged upon completion of the second disposal event and water remaining within the embayment will be pumped out into the holding pond formed by the weirs and

allowed to drain naturally. It is estimated that at least a 100 horsepower, diesel engine pump will be required to pump out the water. To obtain the topsoil, a caterpillar will be used to scarify blackberry thickets and push up soil from the adjacent land. Offroad, 25 cy trucks or other suitable equipment will be used to haul material to the embayment. Transport distance, from the approximate center of the borrow area to the center of the embayment is 1,750 feet. It is presumed that a front-end loader would accomplish loading operations. Leveling of the topsoil in the embayment, to a rough condition, would be accomplished by caterpillar.

Equipment, personnel, fuel, etc., would have to be supplied to Martin Island by boat and barge. No land access route is available.

Marsh vegetation establishment would rely upon natural reestablishment. Natural reestablishment would rely upon seeds and other plant propagules brought into the area by river currents.

Riparian reforestation would occur on approximately 159 acres of lands on Martin Island currently in pasture habitat. Planting density would be 400 cuttings per acre. Species composition per acre would be 250 black cottonwoods, 100 willows, and 50 Oregon ash. Total material requirements are 39,750 black cottonwood, 15,900 willow, and 7,950 Oregon ash; total cuttings equal 63,600. Establishment of riparian trees would be accomplished via sticking of 18" cuttings of willow, Oregon ash and black cottonwood in the late February-early March timeframe. Cuttings would be obtained from Martin and Burke Islands.

Information from USFS-ODNRA

Tree planting (cuttings)- 2,000 cuttings/person/day
$11.88/hr/planter
They add 35% for supervision, transportation and insurance

Based on USFS information, 64 person days would be required to acquire and subsequently stick 63,600 cuttings. Transportation to Martin Island is by boat so costs would have to be adjusted accordingly.

Approximately 144 acres of the agricultural cropland (e.g. pasture) on Martin Island would be tilled as preparation for planting of riparian cuttings. Equipment requirements—All equipment must be field ready at rental; prefer new equipment over used equipment for rental purposes.

2 - 150hp tractors; both equipped with duals; 2wd or 4wd; two hydraulic remotes each.
1 - 15 foot cover crop disk, wheeled, with hydraulic cylinders, hoses and attachments
1 - 16 foot heavy drag harrow, wheeled with hydraulic cylinders, hoses and attachments
1 - 16 foot cultipacker with hydraulic cylinders, hoses and attachments
1 - 16 foot sprocket roller with hydraulic cylinders, hoses and attachments
1 - 16 foot light drag harrow, sectional, with all attachments

Use equipment rental for tractors and field implements. Equipment rentals are for a minimum one month term. Work to be accomplished can be completed in one month.

Requires 2 operators; assume 12 hour days/operator during field season
Requires 1-ton service/maintenance vehicle
Fuel service for tractors; includes bulk tank on site.
Field time for tractors:

Cover crop disk - 6 acres/hr; 24 hrs x 2 passes = 48 hrs; say 56 hrs. for 144 ac
Heavy drag harrow - 6 ac/hr; 24 hrs for 144 ac - say 30 hrs.
Cultipacker compaction - 8 ac/hr; 18 hrs x 1 pass = 18 hrs; say 24 hrs. for 144 ac

Mob/Demob to Woodland Bottoms (use Woodburn, Oregon as base for mileage)
Assume 50% downtime due to weather conditions.
Base fuel cost on total tractor hours.

Operation and management actions post-implementation of mitigation actions will principally entail the control/eradication of blackberry.

WEBB PROPERTY MITIGATION IMPLEMENTATION

The Webb Property is located in the Webb Diking District near Westport, Oregon. Lands at this location are presently used as cattle pasture. The mitigation concepts at Webb Property are directed toward development of wetland and riparian habitat. The site is approximately 145.6 acres in extent. Riparian habitat development would encompass approximately 42 acres. Approximately 101 acres of wetland habitat would be developed through construction of two low levees.

Wetland habitat development would require the emplacement of two water control structures; each structure features a 24-inch diameter, 60 foot long, corrugated steel pipe (CSP) to include a 6' (height), .064 wall thickness, 30" diameter CSP flashboard riser, with a welded bottom plate and 2' stub of 24" CSP (0.064). Pipe and riser would be asphalt dipped. Both structures would be placed through the constructed levees. Other materials requirements for the water control structures are:

140 cys of clean (no fines) 3" minus rock
150 cys - excavation
20 cys - pipe bedding
50 cys Class II riprap
50 sq. ft. of trash rack

Another habitat feature of the wetland habitat development effort would be the construction of two levee systems. The first levee is 6,715 feet in length; the second levee is 3,056 feet in length. Levee crests are 4 feet above ground surface, crest width is 12', and both sideslopes are 1V:6H. Borrow requirements for Levee 1 are estimated at 36,000 cys; Levee 2 requirements are 16,500 cys. Borrow material for the levees would be native materials acquired on the immediate site. An estimated 31,500 cy of material are available from actions to slope the existing slough bank adjacent to Levee 1; the balance of the material requirements would be obtained from borrow areas adjacent to the levee. An estimated 5,000 cys of material are available from actions to slope the existing slough bank adjacent to Levee 2; material to complete the levee would also be borrowed from adjacent lands. Approximately 13,100 of slough banks would be sloped to 1V:6H sideslopes and borrowed material incorporated into the adjacent levee sections.

Levee construction and sloping of slough banks would occur in the August-October timeframe to take advantage of dry soil conditions.

Removal of an estimated 1,600 feet of fence; estimate 4-strand barbwire with 1,000 posts to be removed of which 800 are 6.5' steel posts and 200 are wooden posts.

Riparian habitat would be planted on the 13.5 acres of levees that would be constructed, plus an additional 28.6 acres would be tilled and planted to riparian trees. Planting density would be 400 trees per acre. Species composition per acre would be 250 black cottonwoods, 100 willows, and 50 Oregon ash. Total material requirements are 10,525

black cottonwood and 4,210 willow cuttings, and 2,105 Oregon ash seedlings; total cuttings equal 14,635.

Tillage operations to prepare 28.6 acres of land for riparian plantings would occur in the August-October timeframe to take advantage of dry soil conditions. Establishment of riparian trees would be accomplished via sticking of 18" cuttings of willow and black cottonwood in the late February-early March timeframe, Oregon ash seedlings would be outplanted at the same time. Cuttings and plantings would be obtained from onsite or nearby areas.

The 28.6 acre site would be disked and harrowed (3 passes; equipment in combination; light drag harrow), smoothed with a heavy drag harrow (2 passes), and then compacted with a cultipacker, sprocket roller and light drag harrow (1 pass).

Equipment requirements--all equipment must be field ready at rental; prefer new equipment over used equipment for rental purposes:

1 - 150hp tractors; equipped with duals; 2wd or 4wd; with two hydraulic remotes.
1 - 15 foot cover crop disk, wheeled, with hydraulic cylinders, hoses and attachments
1 - 16 foot heavy drag harrow, wheeled with hydraulic cylinders, hoses and attachments
1 - 16 foot cultipacker with hydraulic cylinders, hoses and attachments
1 - 16 foot sprocket roller with hydraulic cylinders, hoses and attachments
1 - 16 foot light drag harrow, sectional, with all attachments

Use equipment rental for tractors and field implements. Equipment rentals are for a minimum one month term. Work to be accomplished can be completed in one month.

Requires 1 operator; assume 12 hour days/operator during field season
Requires 1-ton service/maintenance vehicle
Fuel service for tractors; includes bulk tank on site.
Field time for tractors:

Cover crop disk in combination with harrow - 6 acres/hr; 5 hrs for 28.6 ac x 3 passes = 15 hrs - say 20 hrs.
Heavy drag harrow - 6 ac/hr; 5 hrs for 28.6 ac x 2 passes = 10 hrs - say 16 hrs.
Cultipacker compaction - 8 ac/hr; 4hrs for 28.6 ac x 2 passes = 8 hrs; say 12 hrs.

Mob/Demob to Westport, Oregon (use Woodburn, Oregon as base for mileage)
Assume 50% downtime due to weather conditions.
Base fuel cost on total tractor hours; say $1,000.

Operation and management actions at this location will primarily entail control/eradication of blackberries in the riparian habitat and maintenance of the water control features.

VIK PROPERTY (PUGET ISLAND) MITIGATION IMPLEMENTATION

The Vik Property is located on Puget Island at Columbia River (CRM 42) near Cathlamet, Washington. Access to the mitigation location is via Washington Highway 4 and the road through Cathlamet to Puget Island.

The mitigation concepts at Vik Property are directed toward development of wetland and riparian habitats. Riparian habitat development would encompass approximately 76 acres. Approximately 31 acres of wetland habitat would be developed.

Wetland habitat development would require the sloping of approximately 12,000 lineal feet of ditch bank to attain bank slopes of 1V:6H. This effort would generate approximately 60,000 embankment cubic yards of material. Material excavated would be placed in 5 disposal areas located on site.

Disposal Site 1 = 1.25 ac: 11,500 cy; 1500 feet roundtrip haul on average;
Disposal Site 2 = 1.5 ac: 15,000 cy; 1000 feet roundtrip haul on average;
Disposal Site 3 = 1.0 ac: 8,500 cy; 1500 feet roundtrip haul on average;
Disposal Site 4 = 1.25 ac: 13,000 cy; 1000 feet roundtrip haul on average;
Disposal Site 5 = 1.25 ac: 12,000 cy; 1500 feet roundtrip haul on average;

Each disposal site would be approximately circular in shape with a crest elevation 12 feet above ground surface elevation. Sideslopes would be 1V:6H. These disposal sites, with establishment of riparian forest habitat, would provide relatively dry, elevated locations for Columbian white-tailed deer.

One ditch crossing of approximately 20' length will have to be constructed. Recommend 2-4' diameter, 16' long concrete culverts. Estimate 170 cys of rock for fill around culverts.

One access road, approximately 500 feet in length by 20 feet wide will be constructed. A 6" layer of 3" minus quarry rock would top a 6" base course of 6" minus (187 cys). The construction site is level and consists of pastureland at present.

Riparian habitat would be planted on 76 acres of land. Planting density would be 400 trees per acre. Species composition per acre would be 250 black cottonwoods, 100 willows, and 50 Oregon ash. Total material requirements are 19,000 black cottonwood and 7,600 willow cuttings, and 3,800 Oregon ash seedlings; total cuttings equal 26,600. Establishment of riparian trees would be accomplished via sticking of 18" cuttings of willow and black cottonwood, and outplanting of Oregon ash seedlings in the late February-early March timeframe. Cuttings would be obtained from onsite or nearby areas. Riparian habitat development would also occur on the 6.25 acres of disposal sites plus an additional 70 acres of land. To facilitate establishment of riparian trees, the 70 acre riparian habitat development area would be tilled in the fall. The site would be disked (3 passes), harrowed with a heavy drag harrow (1 pass), and then compacted with a cultipacker, light drag harrow and roller in combination (2 passes).

Equipment requirements--all equipment must be field ready at rental; prefer new equipment over used equipment for rental purposes.

1 - 150hp tractors; equipped with duals; 2wd or 4wd and two hydraulic remotes
1 - 15 foot cover crop disk, wheeled, with hydraulic cylinders, hoses and attachments
1 - 16 foot heavy drag harrow, wheeled with hydraulic cylinders, hoses and attachments
1 - 16 foot cultipacker, wheeled with hydraulic cylinders, hoses and attachments
1 - 16 foot sprocket roller with hydraulic cylinders, hoses and attachments
1 - 16 foot light drag harrow, sectional, with all attachments

Use equipment rental for tractors and field implements. Equipment rentals are for a minimum one month term. Work to be accomplished can be completed in one month.

Requires 1 operator; assume 12 hour days/operator during field season
Requires 1-ton service/maintenance vehicle
Fuel service for tractor; includes bulk tank mounted on 1-ton truck.
Field time for tractor:

Cover crop disk - 6 acres/hr; 12 hrs x 3 passes = 36 hrs; say 44 hrs. for 70 ac
Heavy drag harrow - 6 ac/hr; 12 hrs for 70 ac - say 16 hrs. for 70 ac
Cultipacker compaction - 8 ac/hr; 9 hrs x 2 passes = 18 hrs; say 24 hrs. for 70 ac

Mob/Demob to Puget Island (use Woodburn, Oregon as base for mileage)
Assume 50% downtime due to weather conditions.
Base fuel cost on total tractor hours; say $3,000.

Operation and management actions at this location will primarily entail control/eradication of blackberries in the riparian habitat.

SVENSEN ISLAND MITIGATION IMPLEMENTATION

Svensen Island is a diked island in the Columbia River just upstream of Settler Point. Knappa, Oregon is the nearest town. Present use of the island is for agricultural pasture.

The mitigation concept at Svensen Island entails construction of 7 levee breaches and planting of riparian habitat on the existing levee right-of-way and disposal sites for levee borrow material. The constructed breaches would have no flow control structures. Natural tidal inundation would be allowed in order to develop an intertidal marsh and/or shallow subtidal habitat.

Breach 1 (western downstream end of island) - This breach would be approximately 300 feet in length and would match the breadth of the existing interior body of water that abuts this location. Breach depth would be to -1 foot NGVD. Borrow material would be placed on and adjacent to the interior slope of the levee abutting Svensen Slough and upstream of the Breach 1 location. Material wasted would be placed in a four foot lift from ground surface tapering to elevation 7.0' NGVD on the levee slope and bladed roughly smooth.

Excavation cubic yards = 3,400
Disposal site acreage = 0.5 acres

Breach 2 (central portion of island abutting Svensen Slough) - This breach would be approximately 250 feet in length and would match the breadth of the existing interior body of water that abuts this location. Breach depth would be to -1 foot NGVD. Borrow material would be placed on and adjacent to the interior slope of the levee abutting Svensen Slough and 200 feet downstream of the Breach 2 location. Material wasted would be placed in a four foot lift from ground surface tapering to elevation 7.0' NGVD on the levee slope and bladed roughly smooth.

Excavation cubic yards = 3,000
Disposal site acreage = 1.5 acres

Breach 3 (near eastern upstream end of island adjacent to Prairie Channel) - This breach would be approximately 125 feet in length on the main levee. Breach depth would be to -1 foot NGVD. Borrow material would be placed on and adjacent to the interior slope of the levee abutting Svensen Slough, downstream of the Breach 4 location, at the farmstead location. Material wasted would be placed in a four foot lift and bladed roughly smooth.

Excavation cubic yards = 1,600

Breach 4 (upstream portion of island abutting Svensen Slough) - This breach would be approximately 125 feet in length and would match the breadth of the existing interior body of water that abuts this location. Breach depth would be to -1 foot NGVD. Borrow material would be placed on and adjacent to the interior slope of the levee abutting

Svensen Slough, downstream of the Breach 4 location, at the farmstead location. Material wasted would be placed in a four foot lift and bladed roughly smooth.

Excavation cubic yards = 1,800
Disposal site acreage = 0.75 acres

Breach 5 (central portion of island adjacent to Prairie Channel) - This breach would be approximately 250 feet in length on the main levee and 125 feet in width on the cross levee. Breach depth would be to -1 foot NGVD. Borrow material would be placed on and adjacent to the interior slope of the levee abutting Svensen Slough and 200 feet downstream of the Breach 2 location. Material wasted would be placed in a four foot lift from ground surface tapering to elevation 7.0' NGVD on the levee slope and bladed roughly smooth.

Excavation cubic yards = 4,500

Breach 6 (central portion of upstream cross levee) - This breach would be approximately 100 feet in width in the cross levee. Breach depth would be to -1 foot NGVD. Borrow material would be placed on and adjacent to the interior slope of the levee abutting Svensen Slough, downstream of the Breach 4 location, at the farmstead location. Material wasted would be placed in a four foot lift and bladed roughly smooth.

Excavation cubic yards = 1,300

Breach 7 (central portion of downstream cross levee) - This breach would be approximately 100 feet in width. Breach depth would be to -1 foot NGVD. Borrow material would be placed on and adjacent to the interior slope of the levee abutting Svensen Slough and 200 feet downstream of the Breach 2 location. Material wasted would be placed in a four foot lift from ground surface tapering to elevation 7.0' NGVD on the levee slope and bladed roughly smooth.

Excavation cubic yards = 1,200

Construction Actions—

Construct 7 levee breaches: Use tracked excavator w/ two 25 cy, offroad equipped dump trucks to haul and place borrow; roughly level borrow material w/ caterpillar.

Disposal: Three disposal locations for levee borrow materials are identified in text.

Demolish dwellings and farm structures: These features are located at three separate locations on Svensen Island. It is estimated that they include three occupied dwellings, one unoccupied dwelling, 2 barns, 13 outbuildings, a boat ramp, boat moorage and boat house. Disposal would be at an approved location.

Riparian plantings: Establishment of riparian trees would entail the sticking of 2,900 18" cottonwood and 2,500 18" willow plantings, at rate of 400 cuttings/acre, on 13.5 acres of retained portions of levee. Willow cuttings would be planted on interior and exterior slopes of remnant portions of the levee from approximately elevation 6.5 feet NGVD to the crest; cottonwood cuttings would be planted on the levee crown. Cottonwood cuttings would also be planted on the disposal areas for levee borrow material. Willow cuttings would be obtained on site. Cottonwood plantings would also be obtained on site and/or from the Corps Astoria field station.

Estimate 48 hrs to gather and plant cuttings
Estimate crew cab pickup required for 6 days
Estimate 4 passenger boat required for 6 days
Estimate miscellaneous supplies at $1,000

Information from USFS-ODNRA
Tree planting (cuttings) - 2,000 cuttings/person/day
$11.88/hr/planter
They add 35% for supervision, transportation and insurance

Miscellaneous: The bridge access to Svensen Island and the road atop the dike extending upstream to breach location number two would be maintained. The bridge and roadbed provide access to houseboats moored alongside Svensen Island in Svensen Slough.

Operation and Mitigation actions would focus on blackberry control/eradication on the small tracts of riparian habitat that would be established at this location.